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EXPERIMENTS WITH SMALL GRAINS ON THE ARLINGTON EXPERIMENT FARM

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HISTORY OF THE EXPERIMENTS

Cereal experiments were begun by the Office of Cereal Investigations at the Arlington Experiment Farm, near Rosslyn, Va., in 1907.[1] In the earlier years the experiments consisted mainly of studies of varietal adaptation, rates of seeding, and the improvement of the principal fall-sown cereals by selection and breeding. More recently the scope of the plat experiments has been broadened. They now include a combined experiment on rate and date of seeding and seedbed preparation and tests of several seed treatments for increasing the yield and controlling diseases, particularly the cereal smuts. The chief purpose of this bulletin is to report the results of the varietal and rate-of-seeding experiments with fall-sown cereals.

In 1916 the results of the investigations conducted in the preceding years were published in detail.[2] Many of the varieties then included have since been discarded and in their stead others have

[1] The experiments here reported are for the 14-year period from 1910 to 1923, inclusive. H. B. Derr was in charge of the work during the crop years 1907 to 1911, T. R. Stanton from 1912 to 1915, A. D. Ellison in 1916 and 1917, T. R. Stanton and W. C. Eldridge in 1918, Henry P. Ames in 1919, and the writer since July, 1919. During the period from 1919 to 1923, inclusive, able assistance was rendered by A. P. Willis and J. P. Seaton, field assistants in the Office of Cereal Investigations. E. C. Butterfield, superintendent of the Arlington Experiment Farm, and J. H. Criswell, assistant superintendent, have cooperated in the conduct of the experiments, and their assistance and advice are gratefully acknowledged.

[2] Stanton, T. R. Cereal experiments in Maryland and Virginia. U. S. Dept. Agr. Bul. 336, 51 p., 6, fig. 1916.

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been added, mainly those of recent origin which give promise of being adapted to eastern conditions. The varietal experiments now include 40 varieties or strains of wheat, 21 of oats, 25 of barley, 14 of rye, 3 of spelt, and 1 of emmer.

The yields of wheat, oats, rye, and barley in Virginia are low. According to the records of the United States Department of Agriculture the average acre yield of wheat in the State during the 5-year period from 1918 to 1922, inclusive, was 11.7 bushels; oats, 21.5; barley, 25.9; and rye, 11.6 bushels. Oats and barley are grown from both spring and fall seeding in Virginia, but wheat and rye are fall sown only. In comparison with the figures just quoted, the yields of the fall-sown cereals at the farm are very good. Individual varieties have proved unadapted; but with few exceptions wheat, rye, spelt, oats, and barley have produced profitable crops annually.

DESCRIPTION OF THE ARLINGTON EXPERIMENT FARM

The Arlington Experiment Farm is situated directly across the Potomac River from the city of Washington, D. C. It is part of the old Arlington estate and comprises the low land lying between the Arlington National Cemetery and the Potomac. The approximate latitude and longitude are 38° 54′ N. and 77° 5′ W., respectively. The altitude is 50 feet. About 400 acres are under cultivation.

SOIL

The soil is a loam, gray to yellow in color, with a subsoil 4 to 10 inches below of a heavy brown or red clay. It is classified by the Bureau of Soils as Keyport silt loam.[3] The soil has great moisture-retaining capacity and in its natural condition is hard to work. A complete system of tile drainage and the continuous use of green manures have greatly lessened the difficulty of cultivation. Baking and clodding still occur, however. The productivity of the soil is high, and though not especially adapted to cereals excellent yields are produced under favorable climatic conditions.

CLIMATIC CONDITIONS[4]

Weather data recorded at the farm are limited to two factors, precipitation and temperature. Fall-sown cereals in general have not suffered greatly from lack of moisture, though periods of dry fall weather have occurred which reduced or delayed germination or checked vegetative growth. Winterkilling or injury due to low temperatures or heaving is seldom severe enough to reduce spring stands of wheat or rye noticeably, but oats and barley have been severely injured in at least 2 of the past 14 years. As a rule, some winter injury occurs annually in these two crops; and when early spring conditions are favorable to the growth of weeds, particularly dog fennel or mayweed, the yields are reduced.

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[3] Carter, W. T., jr., and C. K. Yingling, jr. Soil survey of Fairfax and Alexandria Counties, Va. U. S. Dept. Agr., Bur. Soils, Adv. Sheets Field Oper., 1915, 43 p., illus. 1917.

[4] Weather data at Arlington Experiment Farm are recorded by A. Meyer, to whom the writer is indebted for the facts here presented.

PRECIPITATION

Data on monthly and annual precipitation by crop years from July, 1911, to June, 1923, inclusive, are shown in Table 1. Data for the 12 months from July 1 to June 30 are presented rather than those for the calendar year as more nearly approximating the rainfall available to fall-sown crops. Totals for the three months in spring and early summer—April, May, and June—when the crops make most of their growth, also are given. Weather data were not recorded at the Arlington Experiment Farm previous to March, 1912. Weather data taken at the main Weather Bureau station at Washington, D. C., for the years previous to this date are available, however. Data for the earlier years in which cereal experiments were conducted at the farm were reported by Stanton.[5] Rainfall for the 12 months ended in June, 1910, was 33.22 inches and for the 12 months ended in June, 1911, 48.22 inches. In April, May, and June, 1910, the total rainfall was 8.27 inches, and in the same months in 1911 it was 11.53 inches.

The average rainfall shown in Table 1 for the 12-month periods is 41.39 inches. The crop year of least rainfall was 1917, when 37.45 inches fell. Actual injury to crops from lack of rainfall during spring has never been recorded, but damage due to heavy rains and winds is not uncommon.

TABLE 1.—*Precipitation at the Arlington Experiment Farm for the 12-month periods (crop years) from July, 1911, to June, 1923, inclusive, and monthly average for each period*

[Data (in inches) from records taken by A. Meyer, except that data previous to March, 1912, are from the Weather Bureau station at Washington, D. C.]

Month	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	Average
July	1.36	7.97	2.17	2.80	3.34	5.02	7.75	3.98	7.42	4.97	4.96	7.84	4.97
August	7.11	1.62	5.13	6.47	8.21	2.10	.77	2.33	3.71	4.91	1.67	4.09	4.01
September	2.26	6.59	2.61	.70	1.72	2.91	1.67	3.15	1.68	2.85	3.89	7.65	3.14
October	4.04	.92	4.77	1.71	4.18	1.69	5.21	.94	3.97	.43	.88	1.88	2.55
November	3.98	1.57	2.72	2.27	1.20	2.80	.59	1.55	2.54	4.14	4.64	.60	2.38
December	3.86	3.76	2.53	4.62	2.79	2.34	1.32	4.44	3.27	3.58	1.50	3.80	3.15
	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	
January	2.24	2.84	4.96	6.08	1.28	2.79	4.46	3.83	2.42	2.94	4.65	3.94	3.54
February	2.92	1.32	2.47	4.04	2.81	2.06	.79	2.11	3.07	2.13	2.54	2.42	2.39
March	6.54	4.08	2.01	.94	2.53	6.24	5.12	4.16	2.44	2.34	4.52	4.18	3.76
April	2.19	6.12	3.71	1.07	3.07	2.36	6.74	3.53	4.58	3.72	1.81	4.46	3.61
May	4.40	4.91	1.78	2.66	2.59	2.21	2.76	6.00	1.60	6.46	4.53	1.49	3.45
June	3.94	2.44	6.69	6.74	8.21	4.93	1.83	2.95	4.51	3.47	4.14	3.40	4.44
Total:													
For crop year	44.84	44.14	41.55	40.10	41.93	37.45	39.01	38.97	41.21	41.94	39.73	45.75	41.39
For April, May, and June	10.53	13.47	12.18	10.47	13.87	9.50	11.33	12.48	10.69	13.65	10.48	9.35	11.50

RAINFALL AND YIELD OF WINTER WHEAT

The highest yields of winter wheat were obtained in 1917, when the average of all varieties grown continuously from 1912 to 1923, inclusive, was 15.5 bushels higher than the average for the same varieties in this 12-year period. The poorest wheat year was 1921, when the same varieties averaged about 10.8 bushels below the 12-

[5] See footnote 2, on p. 1.

year average. Both the 1917 and 1921 crops were grown on the same portion of the farm and under as similar cultural treatment as possible. The spring stands were slightly better in 1921 than in 1917. The rainfall during April, May, and June, 1917, was low, the total being 2 inches less than the 12-year average for those months, whereas that for the same months in 1921 was slightly over 2 inches more than the 12-year average.

Figure 1 shows graphically the annual average yields of the 17 varieties of winter wheat grown continuously during the period in which weather data have been recorded at the farm and the total April, May, and June rainfall for each year of the 12-year period from 1912 to 1923, inclusive, the precipitation curve being inverted. The number of factors involved in determining yield as well as the short period covered by the graph allow no definite conclusions. It appears, however, that heavy total precipitation during the season of active growth in spring has not resulted in high wheat yields. The three

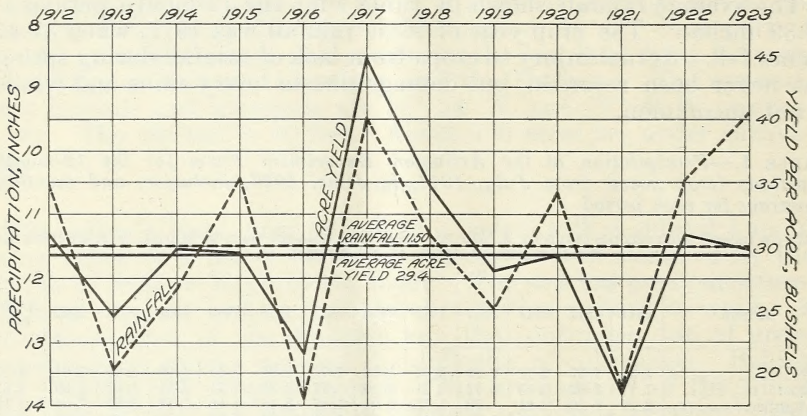


FIG. 1.—Diagram showing the annual average yields of 17 varieties of winter wheat grown at the Arlington Experiment Farm continuously during the 12-year period, 1912–1923, inclusive, and the total April, May, and June rainfall for each year

poorest wheat years—1913, 1916, and 1921—are those in which the precipitation totals are highest. High yields, however, have not followed exactly the inverted rainfall curve, though in the years of less than average rainfall better than average yields have been produced.

The fertile moisture-retentive soil produces a rank, vigorous growth of wheat and large yields of straw. Under unfavorable conditions, such as heavy rains about heading time, lodging is severe and often materially reduces wheat yields, the reduction depending somewhat on the degree of lodging and the stage of development at which it occurs. In 1922, head samples selected from a portion of a plat which had lodged when the plants were fully headed were compared with head samples from a near-by unlodged section of the same plat, notes being taken on the percentage of seed set and the weight of kernels. The data obtained (Table 2) are believed to be typical of the injury done by early lodging to the quantity and quality of the grain produced. Further loss occurs in harvesting lodged plats. Damage also may occur in the shock if the weather is unfavorable, as it is difficult to build good shocks with tangled bundles of lodged

grain. The lodging of wheat in the rate-of-seeding experiments in 1922 is shown in Plate I.

TABLE 2.—*Effect of lodging on the percentage of seed set and on the weight of kernels of Purplestraw wheat grown at the Arlington Experiment Farm in 1922*

Condition	Number of heads examined	Average number per head		Seed set	Weight of 1,000 kernels
		Flowers	Seeds		
				Per cent	*Grams*
Lodged	178	28.3	20.9	73.9	16.86
Not lodged	182	28.2	25.3	89.7	25.89

TEMPERATURE

The maximum and minimum temperatures from 1912 to 1923, inclusive, for the months from October to June, and the mean temperatures for each month from July, 1912, to June, 1923, are shown in Table 3. The minimum temperature is an important factor in yields of fall-sown barley and oats, as is more fully brought out in describing the experiments with winter oats. In years in which a prolonged period of hot weather occurs in June when wheat and oats are ripening, the plants have ripened prematurely, with a corresponding lowering of the quality and quantity of the grain.

TABLE 3.—*Maximum, minimum, and mean monthly temperatures at the Arlington Experiment Farm, by months, for stated years*

[Data recorded (in degrees F.) by A. Meyer]

Month	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	Average
Maximum:												
October	88	80	84	83	89	82	83	92	87	77	91	
November	75	77	79	78	77	70	71	71	74	80	76	
December	72	65	64	58	72	50	67	69	67	64	64	
	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	
Maximum:												
January	67	72	62	71	58	46	61	56	68	62	64	
February	71	62	67	61	66	69	63	55	73	70	60	
March	77	75	62	73	82	80	75	76	87	77	80	
April	86	83	96	86	87	80	83	83	93	89	85	
May	93	97	88	97	91	96	92	85	90	89	91	
June	99	97	92	90	98	97	94	95	96	93	100	
	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	
Minimum:												
October	35	31	26	34	33	26	32	39	30	31	32	
November	20	25	18	24	21	17	21	25	15	26	23	
December	13	21	1	16	11	−5	20	2	18	15	16	

TABLE 3.—*Maximum, minimum, and mean monthly temperatures, etc.*—Continued

Month	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	Average
Minimum:												
January	23	8	17	6	12	−2	10	7	11	−2	20	.....
February	12	−3	18	4	0	−7	16	10	18	5	12	.....
March	17	10	21	14	24	20	26	16	26	23	19	.....
April	32	25	30	31	29	28	22	29	29	31	15	.....
May	41	37	41	42	39	37	43	34	43	39	36	.....
June	42	46	48	46	50	46	51	50	49	53	55	.....

Month	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	Average
Mean monthly:												
July	76.3	77.4	76.5	76.3	79.0	78.0	75.1	77.2	74.3	78.9	77.0	76.9
August	74.5	74.5	77.2	74.2	76.8	77.1	77.3	73.3	74.9	72.5	73.5	75.1
September	71.0	67.8	65.1	71.4	68.4	65.2	64.2	69.3	68.8	74.0	71.2	68.8
October	59.9	59.5	58.7	59.4	58.0	51.7	59.3	63.8	60.2	55.6	60.1	58.7
November	45.7	46.8	43.4	46.8	47.3	42.1	44.5	46.5	44.3	46.5	48.3	45.7
December	39.6	39.1	32.7	35.0	35.5	27.2	38.8	31.2	37.6	36.6	37.6	35.5

Month	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	Average
Mean monthly:												
January	43.9	37.2	34.4	39.3	34.6	23.3	36.8	27.1	35.1	29.8	36.0	34.3
February	36.3	28.5	38.4	34.5	33.3	34.7	36.2	31.4	37.7	35.6	32.8	34.5
March	48.9	38.5	38.7	38.3	43.7	46.9	46.3	43.6	55.6	44.4	45.6	44.6
April	55.3	52.5	58.6	52.5	54.7	53.0	53.1	51.2	59.6	55.2	54.0	54.5
May	66.5	65.4	62.9	67.3	60.3	69.3	64.3	59.0	62.3	67.6	63.7	64.4
June	73.1	73.5	70.6	70.7	73.9	71.4	74.1	70.5	74.0	75.1	76.2	73.0
Average	57.6	55.1	54.8	55.5	55.5	53.3	55.8	53.7	57.0	56.0	56.3	55.5

Table 4 shows the date of the last frost in spring and the first frost in fall, together with the length of the frost-free period, in the years 1912–1923, inclusive. The average frost-free period is 195 days. Late spring frosts do not often injure small-grain crops in this locality.

TABLE 4.—*Dates of late spring and early fall killing frosts and length of frost-free period at the Arlington Experiment Farm in the 12-year period, 1912–1923, inclusive*

Year	Last frost in spring		First frost in fall		Frost-free period
	Date	Temperature	Date	Temperature	
		° F.		° F.	*Days*
1912	Apr. 9	30	Nov. 3	32	207
1913	do	32	Oct. 22	31	195
1914	Apr. 14	32	Oct. 29	31	197
1915	Apr. 5	30	Nov. 4	31	212
1916	Apr. 11	31	do	32	206
1917	Apr. 15	29	Oct. 7	32	174
1918	Apr. 14	32	Oct. 23	32	191
1919	Apr. 27	32	Nov. 9	32	195
1920	Apr. 15	29	Oct. 30	29	197
1921	Apr. 11	31	Oct. 14	31	185
1922	Apr. 25	32	Oct. 21	32	178
1923	Apr. 10	31	Nov. 2	26	205
Average	Apr. 14		Oct. 27		195

EXPERIMENTAL METHODS

PREPARATION OF THE LAND

The land on which the cereals are grown is prepared immediately after harvest, usually about July 1, and sown to cowpeas. The cowpeas are plowed under in the fall and the land sown to rye, which in turn is plowed under for green manure in the following spring. Previous to 1919 the rye was followed by cowpeas, which were plowed under in September, and the land was then prepared for sowing to the cereals. In 1919 and succeeding years this crop of cowpeas was replaced by a crop of soybeans, which was harvested for seed. The land was plowed each year before seeding the cereals, except that it was disked for oats in 1921 and for wheat in 1922. Two tracts of land are used in rotation for the cereal experiments, the cereals and soybeans in alternation, with intervening green-manure crops of cowpeas and rye.

After plowing the land is disked and harrowed as may be necessary to make a good seed bed for the fall-sown cereals. Acid phosphate at the rate of 200 pounds to the acre is applied to all plats in the varietal experiments at seeding time. Stable manure at the rate of 10 tons to the acre has been applied occasionally to sections lacking in humus. The seed is sown with a grain drill.

PLAT EXPERIMENTS

The yields recorded for 1910 to 1914, inclusive, are based on data obtained from single or duplicate twentieth-acre plats, each 16.5 feet by 132 feet. In 1915 and succeeding years wheat was grown in fortieth-acre plats, each 8.25 by 132 feet, with usually three replications. Beginning in 1916 the varietal experiments with barley were conducted in duplicate on fortieth-acre plats. Oats continued to be grown in duplicate twentieth-acre plats until 1919, since which time fortieth-acre plats have been used. Rye has been grown in single twentieth-acre plats in the wheat series. The alleys between the plats are 18 inches wide, and the roadways between the series are 19.8 feet wide. A general view of the wheat and rye plats in 1922 is shown in Plate II.

Since the fortieth-acre plat has been used, the practice has been to have three replications of wheat and oat varieties and two of barley. Every fifth plat is a check of a standard variety. The yields reported, however, are all actual, no corrections having been made for soil variation as indicated by yields of check plats.

TABLE 5.—*Rates and dates of seeding for winter cereals grown at the Arlington Experiment Farm in the 14-year period, 1910–1923, inclusive*

Crop	Rate of seeding per acre (pecks)	Approximate date of seeding
Wheat	6	Oct. 6
Oats:		
Culberson, Winter Turf	8	Sept. 29
Fulghum, Red Rustproof	12	Do.
Barley	8	Oct. 1
Rye	6	Oct. 6
Spelt and emmer	10 to 12	Do.

RATES AND DATES OF SEEDING

The seeding rates and dates are shown in Table 5. Seeding earlier than the dates shown in this table is not believed to be so satisfactory, but wheat and rye may be sown as late as October 30 and still produce good crops.

EXPERIMENTAL DATA

WINTER WHEAT

Experiments with winter wheat reported here include a varietal experiment beginning in 1910 in which 54 varieties or selections have been grown for three or more years and a rate-of-seeding experiment conducted from 1913 to 1923, inclusive.

VARIETAL EXPERIMENTS

The annual and comparable average yields of the varieties or selections of winter wheat grown in the varietal experiments are shown in Table 6. During the 14-year period, 1910–1923, inclusive, 14 varieties have been grown continuously. New varieties are added to the list annually, and this necessitates the discarding of many of those showing little promise of high yield or other good qualities. Varieties grown for three years or less and discarded before 1915 are not included in Table 6. Yields of these varieties were reported in Department Bulletin No. 336.[6]

Winter wheat has produced fair to good yields in each of the 14 years from 1910 to 1923, inclusive. An exceptionally high yield was obtained in 1917 and an unusually low one in 1921. Spring freezes shortly before heading time may have been a factor in reducing the yield in 1921, as 10 per cent of the spikes were found to be sterile in plats of Purplestraw wheat (C. I. No. 1915). Unusually high temperatures in March and April resulted in extremely early heading in that year.

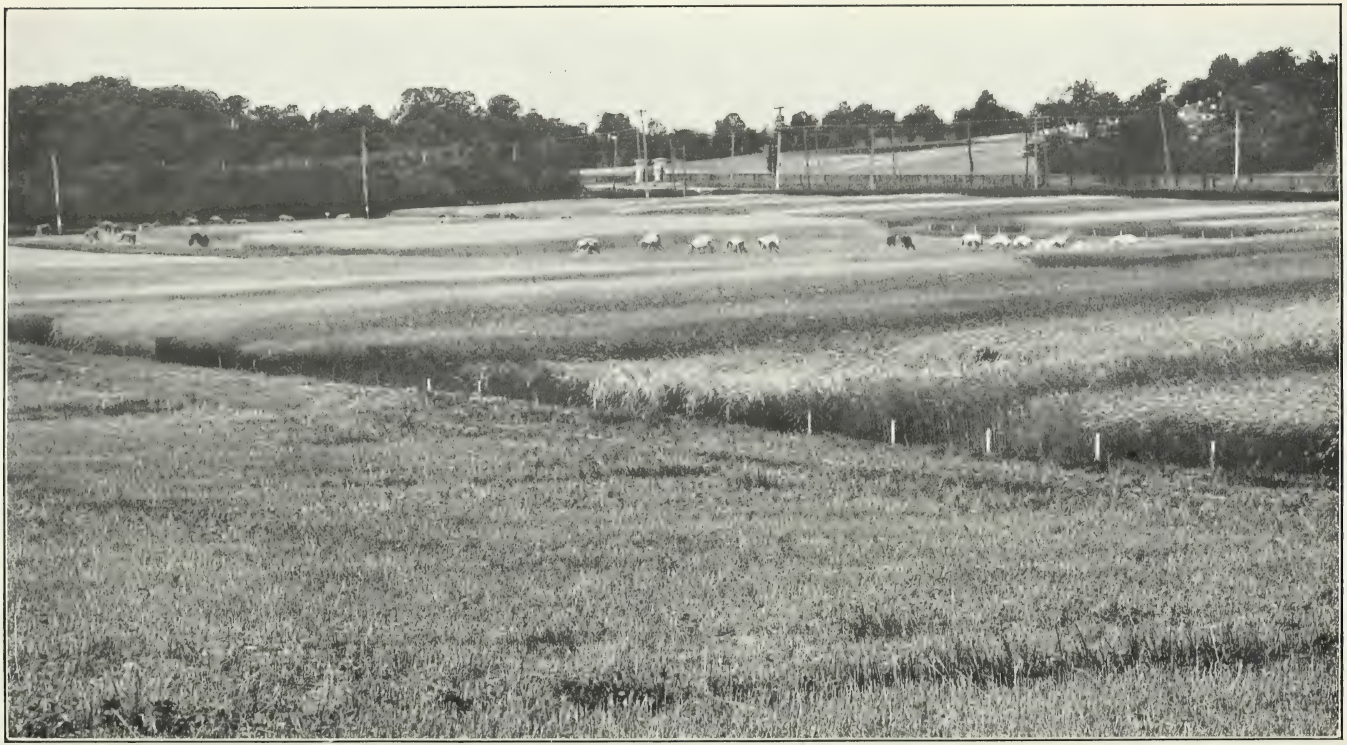
As shown in Table 6, Purplestraw (C. I. No. 1915) has produced the highest average yield in the 14-year period, 31.9 bushels. A selection (C. I. No. 1733) here named Potomac, ranks second, followed by Purplestraw (C. I. No. 1957), Poole (C. I. No. 1979), and Fultz (C. I. No. 1923). The 6-year average yields (1918–1923) permit a comparison of 28 varieties and strains. Poole (C. I. No. 1979), Purplestraw (C. I. No. 1957), and Shepherd (C. I. 6163) are the leading varieties in this period. Descriptions and histories of the two new varieties, Potomac and Shepherd, are here given.

Description of Potomac.—Plant winter habit, midseason, midtall; stem purple, midstrong; spike awnless, fusiform, middense to lax, inclined to nodding; glumes glabrous, brown, midlong, midwide; shoulder midwide, oblique to square; beaks wide, obtuse, 0.5 millimeter long; apical awns several, 3 to 15 millimeters long; kernels red, midlong, soft, ovate to oval; germ small to midsize; crease midwide, shallow to middeep; cheeks usually rounded; brush small to midsize, midlong.

History of Potomac.—The seed from which Potomac was developed was obtained originally from Cornell University, Ithaca, N. Y., in 1900, under the name Dawson Golden Chaff. Its identity as a white-kerneled variety appears to have been lost, at least by 1914, either through mass selection or otherwise. It has been grown in plats since 1910 at the Arlington Experiment Farm, where it has been one of the best-yielding varieties.

[6] See footnote 2, p. 1.

WINTER WHEAT LODGING AT THE ARLINGTON EXPERIMENT FARM IN 1922



WHEAT AND RYE PLATS AT HARVEST TIME AT THE ARLINGTON EXPERIMENT FARM IN 1922

TABLE 6.—*Yields of varieties and strains of winter wheat grown at the Arlington Experiment Farm in the 14-year period, 1910–1923, inclusive*

Group and variety	C. I. No.	Annual and average acre yields (bushels)														Average	
		1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	14 yrs., 1910 to 1923	6 yrs., 1918 to 1923
AWNLESS VARIETIES																	
Glumes glabrous, white; kernels white:																	
Martin	1974	25.7	21.9	31.5	20.0	23.7	27.2	16.8									
Glumes glabrous, white; kernels red:																	
Fultz	1923	37.6	25.2	31.2	22.7	29.1	40.4	23.7	51.4	37.1	30.7	27.0	13.5	31.5	26.7	30.6	27.8
Fultz selection	1923-1						33.5	20.8	49.4	34.1							
Do	1923-4								49.7	32.2							
Fultz	3598								53.4	31.1	28.3	28.0	16.4	26.0	20.5		25.1
Fultzo-Mediterranean	1980	18.0	21.7	28.8	19.2	22.5											
Leap	4823						24.5	22.9	48.4	40.9	27.3	33.9	21.7	31.2	25.7		30.1
Maryland Flint	1949	22.3	32.3	29.1	23.5	23.7											
Power [1]	3697											14.9	13.6	19.7	25.2		
Purplestraw	1915	24.6	25.8	37.2	34.7	38.2	31.4	23.1	52.7	36.3	27.4	30.7	19.8	31.2	33.0	31.9	29.7
Do	1957	26.0	31.3	33.1	24.2	30.8	32.0	19.8	47.0	35.0	30.7	34.1	20.2	37.4	30.9	30.9	31.4
Harvest Queen	6883													31.9	26.6		
Forward	6691													26.7	31.8		
Glumes glabrous, brown; kernels white:																	
Dawson	6161										25.0	24.9	21.7	30.4	29.1		
Glumes glabrous, brown; kernels red:																	
China	180				21.8	20.0	31.1	20.0	46.2	36.3	32.7	26.1	19.3	25.5	28.6		28.1
Currell	3326				20.2	30.3	26.5	21.8	50.1	38.3	27.7	27.1	16.4	26.1	21.0		26.1
Hybrid	3610	30.3	16.7	29.2	22.0	21.0											
Illini Chief	5406									35.1	25.7	25.4	15.2	31.6	29.0		27.0
Michigan Amber	1969		28.0	28.8	21.0	21.0	25.8	17.8									
Poole	1979	31.7	24.3	31.9	26.6	29.2	31.2	21.7	47.4	42.2	28.0	31.1	23.0	32.7	31.8	30.9	31.5
Do	3489								53.1	40.8	27.3	31.9	23.6	28.2	33.7		30.9
Potomac	1733	25.1	24.8	36.0	25.8	35.2	32.6	25.4	52.4	41.2	28.3	30.1	18.7	30.5	29.8	31.1	29.8
Potomac selection	1733-3									37.4							
Do	1733-4								49.1	38.3							
Shepherd	6163									37.2	36.0	29.4	18.7	32.6	31.9		31.0
Glumes pubescent, white; kernels red:																	
Haynes Bluestem [1]	2874											14.6	12.6	24.3	23.4		
Hybrid	3618	20.0	22.5	30.5	20.8	22.2											
Glumes pubescent, brown; kernels red:																	
Brown Fife	1933	26.7	22.8	24.0	24.7	24.7	31.2	23.3	44.1	34.7	22.0	28.6	19.5	29.0	28.5	27.4	27.1
AWNED VARIETIES																	
Glumes glabrous, white; kernels red, soft:																	
Bearded Purplestraw	1911	25.0	20.1	28.7	23.2	22.3	25.1	21.3	38.9	34.0	32.3	28.7	23.7	24.6	30.4	27.0	29.0
Do	1911-1								50.0	32.7	30.3	28.1	18.2	25.1	23.1		26.3
Dietz	1981	31.5	25.2	28.3	21.1	28.2	23.8	19.8	37.5	35.3	27.7	30.2	21.0	28.4	31.3	27.8	29.0
Dietz selection	1981-11						35.4	18.1	39.7	36.7							
Dietz	3386								34.1								
Fulcaster	1945	31.0	28.8	29.1	26.5	33.3	28.0	24.7	38.2	30.4	28.3	30.9	22.5	32.8	28.3	29.5	28.9
Do	6162									37.2	31.7	28.2	24.3	31.7	28.6		30.3
Mammoth Red	2008	29.2	25.3	29.2	25.2	28.2	28.0	23.1	37.1	33.8	31.3	31.1	19.5	35.3	28.0	28.9	29.8
Fulcaster selection [2]	1912-2								56.1	31.9	25.0	31.7	18.1				
Stoner	2980		25.2	30.2	22.0	32.3	29.0	18.5	34.4	28.1	32.0	28.2	19.2	27.6	30.6		27.6
Pennsylvania No. 44	6882													31.3	37.4		
Hybrid	3611	20.0	20.7	21.6	15.7	24.7											
Do	3617			21.7	34.7	21.8	27.8										
Do	3612			13.8	20.3	19.7	24.5	27.2	20.6								
Fishhead [3]	1732	30.8	17.3	27.3	21.7												

[1] Spring wheats fall sown. [2] Selection from Missouri Bluestem. [3] Not true Fishhead.

TABLE 6.—*Yields of varieties and strains of winter wheat grown at the Arlington Experiment Farm in the 14-year period, 1910–1923, inclusive*—Continued

Group and variety	C. I. No.	Annual and average acre yields (bushels)																
		1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	Average 14 yrs., 1910 to 1923	Average 6 yrs., 1918 to 1923
AWNED VARIETIES—con.																	
Glumes glabrous, white; kernels red, semihard or hard:																	
Kanred	5146									28.3	16.7	15.4	18.6	25.7	24.6		21.6
Nebraska No. 28	5147									32.3	24.3	22.8	12.8	19.1	10.4		20.3
Preston [1]	3081											14.4					
Glumes glabrous, brown; kernels white:																	
Genesee Giant	1744	24.2	20.3	30.7	28.4	32.5	27.6	21.0	50.0	33.5	27.0	29.9	17.2	30.6	29.6	28.8	28.0
Amber Longberry	1973		26.5	29.5	22.7	29.5	23.2	21.7	46.0	34.5	23.2	28.1	14.4	27.8	28.6		26.1
Glumes glabrous, brown; kernels red:																	
Hybrid	3609	24.3	14.7	32.5	18.0	23.3											
Do	3613		12.0	22.3	19.7	31.2	25.3										
Do	3614		16.8	30.1	19.2	31.3	31.2	18.9	51.2	37.5	31.7	27.3	16.7	34.3	29.3		29.5
Do	3608	29.7	21.2	31.7	19.1	25.3	25.7	22.1	39.7	34.8	19.7	28.4	11.8	28.3	28.7	26.2	25.3
Missouri Bluestem	1912	22.2	28.6	32.1	22.5	28.7	29.1	18.6	47.7	33.1	29.7	27.4	16.0	32.7	30.3	28.5	28.2
Missouri Bluestem selection	1912–15								46.7	30.2							
Red Rock	5976										31.7	31.0	23.0	31.1	34.1		
Rocky Mountain	1930	26.8	25.8	31.5	26.2	26.3	30.8	20.0	47.0	31.1	27.7	26.1	18.8	30.2	31.9	28.6	27.6
Mediterranean selection [2]	3115–2									40.1	23.7	22.7	15.9				
Glumes pubescent, white; kernels white:																	
Bearded Winter Fife	1942	30.0	26.6	36.4	24.9	23.3	26.0	21.9	49.0	34.9							
Do	4204				22.8	36.8	30.1	21.9	50.7	32.5							
Glumes pubescent, white; kernels red:																	
Hybrid	3616	25.7	20.0	29.7	16.1	31.0											
Virginia	3277		24.5	35.1	21.0	21.5	18.7	16.6									

[1] Spring wheats fall sown.

[2] Selection from Fulcaster (Acme).

Description of Shepherd.—Plant winter habit, fall and spring vegetative growth; semierect, midseason, midtall; stem purple, midstrong; spike awnless, fusiform, middense to lax, erect; glumes glabrous, brown, midlong, midwide; shoulder midwide, oblique to square; beaks wide, obtuse, 0.5 to 1 millimeter long; apical awns several, 3 to 20 millimeters long; kernels red, midlong, soft, ovate to oval, germ small to midsize, crease shallow to middeep, cheeks usually rounded; brush small to midsize, midlong.

History of Shepherd.—Shepherd originated from a head selection made in 1912 at Cornell University by C. E. Leighty from plants grown from seed obtained from the Indiana Agricultural Experiment Station. It was first grown in a head row in 1913 at the Arlington Experiment Farm, where it appeared promising and was increased, first in rod rows and later in plats. On the beginning of experiments for the control of the flag-smut and rosette diseases of wheat at Granite City, Ill., in 1919, Shepherd was among the strains sown and subjected to infection. Proving highly resistant to or immune from both diseases, it has been increased both at the Arlington Experiment Farm and in the Granite City area and distributed to farmers. In the fall of 1923 about 100 acres were sown with this variety.

Fulcaster (C. I. No. 6162) and Mammoth Red have produced high yields in the awned white-chaffed group, as has a hybrid (C. I. No. 3614) in the Mediterranean group. Genesee Giant has produced the best yield of any of the white wheats. Kanred and Nebraska No. 28

have proved to be unadapted. They are lacking in spring vigor and produce poorly filled heads. Preston, Power, and Haynes Bluestem, hard red spring wheats sown in the fall, though seldom winterkilled are late in maturing and have yielded poorly. Red Rock, a variety developed at the Michigan Agricultural Experiment Station, has yielded more than any other bearded wheat and ranks second of all varieties in the 5-year period, 1919–1923, inclusive.

Figure 2 shows graphically the average yields of six varieties of winter wheat in the 6-year period, 1918–1923, inclusive. Representative heads of four varieties are shown in Figure 3.

The varietal experiments begun in 1910 included 26 varieties of common wheat, 13 of which were awnless and 13 awned. Power, an awnless spring wheat, was grown in only one year and then discarded. After yield data had been obtained for four or more years, varieties of poor yielding ability usually were discarded. Six awnless and eight awned wheats were grown during the entire period from 1910 to 1923, inclusive. Five of the six awnless wheats have higher average yields for the 14-year period than any of the awned varieties.

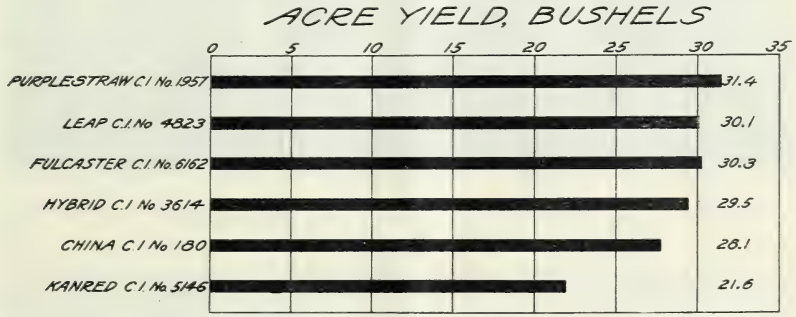


FIG. 2.—Diagram showing the average yields of six varieties of winter wheat grown at the Arlington Experiment Farm in the 6-year period, 1918–1923, inclusive

The average acre yield of the six awnless varieties for this period was 1.8 bushels higher than that of the six best awned varieties. The 6-year average (1918–1923) permits a comparison between 13 awnless and 15 awned varieties and strains. Five of the six leading varieties are awnless, two of them being recent introductions into the varietal experiments. The average acre yield of the 10 highest yielding awned varieties from 1918 to 1923, inclusive, was 28.8 bushels, as compared with 29.7 bushels for the 10 highest yielding awnless varieties.

Table 7 shows the average agronomic data recorded for 17 varieties of winter wheat grown during the 12-year period, 1912–1923, inclusive. The superior yield of the awnless varieties may be readily seen. Purplestraw (C. I. No .1915) and Fultz are very similar in their growth habit, both producing a high yield of grain and a low yield of straw. Plats of Purplestraw and Red Rock wheats are shown in Figure 4. Purplestraw (C. I. No. 1957) grows taller than either Purplestraw (C. I. No. 1915) or Fultz and produces a higher ratio of straw to grain. The two strains of Poole wheat included, C. I. No. 1979 and Potomac (C. I. No. 1733), are somewhat similar in habit of growth and time of maturity. Both are of midheight and produce considerable straw as well as grain.

FIG. 3.—Heads of winter-wheat varieties grown at the Arlington Experiment Farm. Left to right: Rocky Mountain, Shepherd, Purplestraw, Mammoth Red

FIG. 4.—Wheat plats at the Arlington Experiment Farm in 1922: Purplestraw, C. I. No. 1915, on the left and Red Rock on the right. Each of these plats yielded more than 30 bushels to the acre

The bearded wheats included in Table 7, with the exception of Genesee Giant, are all midhigh or tall and as a group produce a low ratio of grain to straw. This is especially noticeable in Missouri Bluestem and Hybrid (C. I. No. 3608), two wheats of the Mediterranean type, and in Amber Longberry, a white wheat. Genesee Giant, another white wheat, produces a short, stiff straw and has the highest ratio of grain to straw of any of the awned varieties.

Lodging is possibly a factor in aiding the awnless wheats to outyield the awned forms at the Arlington Experiment Farm. Under similar soil and climatic conditions it is believed that the awned varieties, with the exception of Genesee Giant, normally will be reduced in yield more frequently and severely by lodging than the awnless varieties mentioned in Table 7.

TABLE 7.—*Average agronomic data for 17 varieties of winter wheat grown at the Arlington Experiment Farm in each of the 12 years, 1912–1923, inclusive*

Variety	C. I. No.	Date of—		Height	Acre yields		Ratio of grain to straw	Bushel weight
		Heading	Maturity		Grain	Straw		
				Inches	*Bushels*	*Pounds*		*Pounds*
Purplestraw	1915	May 20	June 17	46	33.0	4,258	1: 2.15	60.4
Do	1957	do	June 18	49	31.3	4,590	1: 2.44	60.1
Fultz	1923	May 21	do	48	30.4	4,102	1: 2.25	59.7
Poole	1979	May 22	June 22	51	31.4	4,545	1: 2.41	59.3
Potomac	1733	May 23	do	50	32.2	4,413	1: 2.28	58.7
Fulcaster	1945	May 22	June 20	52	29.4	4,524	1: 2.56	59.2
Dietz	1981	do	do	52	27.7	4,214	1: 2.54	60.0
Mammoth Red	2008	May 23	do	52	29.2	4,336	1: 2.47	59.6
Bearded Purplestraw	1911	May 22	do	51	27.8	4,439	1: 2.66	59.5
Stoner	2980	do	June 19	51	27.7	4,340	1: 2.61	59.7
Missouri Bluestem	1912	May 24	June 22	52	29.0	4,823	1: 2.77	58.8
Rocky Mountain	1930	May 23	June 21	51	29.0	4,618	1: 2.65	59.7
Hybrid	3608	do	do	51	26.3	4,324	1: 2.74	59.4
Do	3614	May 24	June 23	54	29.9	4,515	1: 2.52	58.7
Amber Longberry	1973	May 26	do	53	27.4	4,744	1: 2.89	58.8
Genesee Giant	1744	May 24	do	47	29.8	4,087	1: 2.29	57.4
Brown Fife [1]	1933	May 25	June 21	48	27.9	4,348	1: 2.60	58.4

[1] The name "Brown Fife" was given in 1922 to a strain of wheat formerly grown as Jones Winter Fife. In habit of growth and morphological characters it is somewhat similar to Grandprize.

RATE-OF-SEEDING EXPERIMENTS

Rate-of-seeding experiments with Fultz, Dietz, Martin, and Stoner wheats were conducted from 1913 to 1916, inclusive, with seeding rates per acre ranging from 2 to 8 pecks, inclusive. In 1917 the Martin was dropped from the test, and the 10-peck rate was added for the other varieties. In 1918 the 9-peck rate also was included. The data for each rate are based on the average yield from two fortieth-acre plats. An experiment in which rate and date of seeding and method of preparing the seed bed were all involved was begun with Purplestraw wheat in 1919. The rate-of-seeding data shown for this variety represent the annual average yields from 10 fortieth-acre plats for each seeding rate in the 5-year period from 1919 to 1923, inclusive. The annual and average yields are presented in Table 8.

The general average of all varieties in the 11-year period from 1913 to 1923, inclusive, shows the 6-peck rate to be the most profitable, although the net gain over the 4-peck rate is only 0.2 bushel. The effectiveness of a seeding rate, however, may vary with the variety. The most profitable rate for Fultz was 7 pecks, for Martin 5 pecks, for Stoner and Purplestraw 6 pecks, and for Dietz 8 pecks.

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Table 8 shows that Purplestraw produced a higher yield from the 8-peck than from the lower rates in three of the five years; but the 5-year net average shows no gain over the 6-peck rate, and Fultz shows little gain from seeding more than 4 pecks. Dietz produced a 6-year average yield of 26.9 bushels from the 8-peck rate, 0.3 bushel in excess of the next highest yield, but Stoner in the same period showed a net loss of 1.9 bushels from sowing 8 pecks as compared with the 6-peck rate from which the highest average yield was obtained.

TABLE 8.—*Yields obtained in rate-of-seeding experiments with winter-wheat varieties grown at the Arlington Experiment Farm during the 11-year period, 1913–1923, inclusive*

Variety and seeding rate	Acre yields (bushels)												
	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	Average	Net average
Fultz (C. I. No. 1923):													
2 pecks	19.1	29.7	21.6	16.9	42.1	26.7						26.0	25.5
3 pecks	22.7	33.0	23.9	21.4	50.9	28.4						30.1	29.4
4 pecks	24.7	39.0	29.9	24.7	51.1	31.4						33.5	32.5
5 pecks	24.6	37.7	32.2	23.4	53.7	30.5						33.7	32.5
6 pecks	24.0	36.2	29.8	22.7	54.0	34.0						33.5	32.0
7 pecks	21.3	37.4	28.4	25.8	54.4	38.2						34.3	32.6
8 pecks	24.8	37.9	27.3	24.7	46.7	38.4						33.3	31.3
9 pecks						37.5							
10 pecks					50.7	34.5							
Dietz (C. I. No. 1981):													
2 pecks	18.9	26.7	8.3	17.7	36.4	22.7						21.8	21.3
3 pecks	19.9	30.0	12.4	19.7	42.4	30.7						25.9	25.2
4 pecks	16.8	29.5	19.3	24.7	40.5	34.5						27.6	26.6
5 pecks	18.7	27.8	21.2	17.0	38.7	35.2						26.4	25.2
6 pecks	19.4	29.7	22.9	22.0	36.1	35.9						27.7	26.2
7 pecks	17.4	30.6	23.1	23.4	38.0	35.4						28.0	26.3
8 pecks	19.7	32.5	24.0	23.1	39.4	34.9						28.9	26.9
9 pecks						34.3							
10 pecks					35.4	34.0							
Stoner (C. I. No. 2980):													
2 pecks	17.4	26.9	15.4	19.0	39.3	19.5						22.9	22.4
3 pecks	18.3	30.7	16.9	22.1	37.4	23.8						24.9	24.2
4 pecks	17.1	32.8	22.6	20.7	38.7	28.3						26.7	25.7
5 pecks	17.5	28.9	19.6	23.2	39.7	29.5						26.4	25.2
6 pecks	14.7	29.7	33.7	24.4	37.0	31.2						28.5	27.0
7 pecks	14.5	30.9	26.4	24.7	35.4	30.8						27.1	25.4
8 pecks	16.0	29.8	27.6	24.8	34.1	30.3						27.1	25.1
9 pecks						30.0							
10 pecks					36.7	30.4							
Martin (C. I. No. 1974):													
2 pecks	18.4	22.6	6.9	17.1								16.3	15.8
3 pecks	19.7	27.0	9.7	21.0								19.4	18.7
4 pecks	19.0	26.0	16.0	21.7								20.7	19.7
5 pecks	17.2	24.9	19.7	23.5								21.3	20.1
6 pecks	17.4	27.8	17.5	22.0								21.2	19.7
7 pecks	12.4	25.6	18.5	20.2								19.2	17.5
8 pecks	14.7	23.9	22.5	20.1								20.3	18.3
Purplestraw (C. I. No. 1915):													
2 pecks							18.1	24.9	17.0	28.5	24.2	22.5	22.0
3 pecks							20.5	26.4	19.7	30.2	29.0	25.2	24.5
4 pecks							22.4	26.3	21.1	29.8	30.7	26.1	25.1
5 pecks							21.5	26.7	21.1	31.0	33.3	26.7	25.5
6 pecks							22.3	29.2	21.6	31.6	32.6	27.5	26.0
7 pecks							22.0	28.6	22.2	32.1	31.4	27.3	25.6
8 pecks							24.2	29.0	22.5	33.2	31.1	28.0	26.0

GRAND AVERAGE

Items of comparison	Rate of seeding (pecks)						
	2	3	4	5	6	7	8
Average of all varieties in all years	22.3	25.5	27.4	27.3	28.1	27.7	28.0
Net yield	21.8	24.8	26.4	26.1	26.6	26.0	26.0

It appears that there is either a varietal difference in seeding requirements or else long-time experiments are necessary to overcome the effect of the experimental error.

Table 9 shows the average yields of grain and straw and the bushel weights obtained from different seeding rates with Purplestraw wheat (C. I. No. 1915) for the 5-year period, 1919–1923, inclusive. Yields of straw as well as grain increased at the higher rates of seeding. The higher bushel weight at the 4-peck rate can not be explained. Ratios of straw yields to grain yields also are shown.

TABLE 9.—*Average yields and other data for Purplestraw wheat grown in rate-of-seeding experiments at the Arlington Experiment Farm in the 5-year period, 1919–1923, inclusive*

Seeding rate	Average acre yields		Ratio of grain to straw	Bushel weight
	Grain	Straw		
	Bushels	*Pounds*		*Pounds*
2 pecks	22.5	3,155	1:2.34	58.9
3 pecks	25.2	3,530	1:2.33	58.8
4 pecks	26.1	3,669	1:2.34	59.5
5 pecks	26.7	3,812	1:2.38	59.2
6 pecks	27.5	3,790	1:2.30	59.1
7 pecks	27.3	3,869	1:2.36	59.1
8 pecks	28.0	3,872	1:2.30	59.2

SPRING WHEAT

Spring-sown wheat can not be grown profitably in the vicinity of Washington, D. C. Experiments with wheat seeded during March and April show that the crop does not possess sufficient vigor to combat weeds, rust, and adverse weather conditions, which often occur in this locality. In 1911 and 1912 attempts to grow spring-sown wheat resulted in the production of a few scattered heads each year. During the period from 1915 to 1918, inclusive, Marquis wheat was spring sown either in twentieth-acre or fortieth-acre plats. Yields of Marquis and of fall-sown Purplestraw wheat (C. I. No. 1915) are shown in Table 10. In each of the four years the crop of spring wheat was poor, the 4-year average yield being 6 bushels, as compared with 35.9 bushels from the fall-sown variety.

TABLE 10.—*Yields of spring-sown Marquis and fall-sown Purplestraw wheats grown at the Arlington Experiment Farm, 1915–1918, inclusive*

Variety	Acre yields (bushels)				
	1915	1916	1917	1918	Average
Marquis, spring sown	7.3	4.2	1.1	11.2	6.0
Purplestraw, fall sown	31.4	23.1	52.7	36.3	35.9

WINTER SPELT AND EMMER

Winter spelt has produced high grain yields at the Arlington Experiment Farm, and the crop should be grown more extensively in eastern Virginia for stock feed. Winter emmer, however, has yielded poorly. The kernels of spelt and emmer usually remain inclosed in the glumes, giving the grain considerable bulk. The percentage of chaff to whole grain in the 1922 crop was 26.7 for Alstroum spelt and 28.6 for Black Winter emmer. The average bushel weight of spelt and emmer has been approximately 29 pounds, varying from year to year with the proportion of grain which threshed free from the glumes. Yields of grain, however, are figured on the same basis as oats, 32 pounds to the bushel. Annual and average yields of spelt and emmer are reported in Table 11.

TABLE 11.—*Yields of varieties of winter spelt and winter emmer grown at the Arlington Experiment Farm in the 14-year period, 1910–1923, inclusive*

Crop and variety	C. I. No.	Annual and average acre yields (bushels)														
		1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	Average, 1911 to 1923
Spelt:																
Alstroum	1773	82.5	47.5	73.3	48.1	95.8	76.8	58.5	100.2	91.9	39.6	72.9	45.2	57.1	77.5	68.0
Do	3264	----	45.0	84.1	46.2	100.6	69.0	65.0	91.9	87.7	49.0	70.8	50.1	66.9	86.6	70.2
Do	1772	80.0	42.2	74.9	50.6	91.0	75.5	54.4	96.3	78.8	38.3	79.4	----	----	----	----
White Bearded (Servia)	1724	53.4	38.2	70.0	45.3	81.7	65.2	68.5	85.6	63.9	44.4	68.9	66.2	66.9	77.7	64.8
Emmer:																
Black Winter	2337	32.2	11.0	28.8	19.2	13.6	19.1	30.0	47.2	25.9	10.8	4.9	10.0	19.2	24.5	20.3
White	3628	----	----	----	----	----	6.3	14.5	16.9	13.6	4.8	5.4	----	----	----	----

Difficulty has been experienced in obtaining a good fall stand of spelt and emmer in years of light October rainfall; but the spelts possess strong tillering ability, and yields of more than 70 bushels have followed estimated spring stands of 65 per cent. Growth in fall and spring is slow, especially that of emmer, which is the latest maturing crop grown in the varietal experiments.

Two strains of Alstroum spelt (C. I. Nos. 1773 and 3264) and White Bearded spelt have been grown continuously for 13 or 14 years. Alstroum spelt is awnless and a little later in maturing than White Bearded. Alstroum (C. I. No. 3264) has produced the best yields, the 13-year average being 70.2 bushels as compared with 64.8 bushels from White Bearded. Black Winter emmer during the same period yielded at the rate of 20.3 bushels per acre.

TABLE 12.—*Average agronomic data recorded for the two varieties of spelt and one of emmer grown at the Arlington Experiment Farm in the 14-year period, 1910–1923, inclusive*

Variety	C. I. No.	Date of maturity	Height	Acre yields		Bushel weight
				Grain	Straw	
Spelt:			*Inches*	*Bushels*	*Pounds*	*Pounds*
Alstroum	1773	June 24	46	69.1	3,292	28.4
Bearded Winter	1724	June 23	48	64.0	3,327	29.0
Emmer:						
Black Winter	2337	July 2	47	21.2	1,740	29.7

Agronomic data for spelt and emmer varieties are presented in Table 12. The straw yield of the spelts is less than that of wheat and rye but more than that of oats or barley. The stiff straw of the spelts has prevented lodging in all but the most unfavorable years. Figure 5 shows heads of representative varieties of spelt and emmer.

FIG. 5.—Heads of winter emmer and winter spelt grown at the Arlington Experiment Farm. Left to right: Black Winter emmer, Alstroum spelt, White Bearded spelt

WINTER RYE

Rye varieties and strains have been grown in the varietal experiments since 1911. As rye is generally cross-pollinated, a varietal experiment can not be conducted satisfactorily unless new seed of each variety is obtained annually from localities where it is isolated

from all others. The rye seed used at the Arlington Experiment Farm has been obtained from the varietal plats, and no doubt considerable intercrossing has occurred. To reduce natural crossing between the varieties, the twentieth-acre plats of rye are interspersed among the plats of wheat varieties so that the distance between plats of rye varieties is 80 to 90 feet. To guard further against crossing, early and late rye varieties are alternated. The period during which a variety of rye blooms is so extended, however, that even between the earliest variety grown in the experiment (Abruzzes) and the latest (Rosen) there is opportunity for some crossing to occur. Flowering notes for three varieties in 1921 show that Abruzzes bloomed from April 16 to May 7, Von Rümker from April 22 to May 8, and Rosen from April 26 to May 21. A similar overlapping of the flowering period was recorded in 1922. The opportunity for natural crossing between Rosen and Abruzzes is not so great as the dates of flowering indicate, because the extremely late dates in each case represent the flowering of the spikes on the smaller and later tillers.

Rye usually has produced high yields. As in wheat, low yields occur when spring rainfall is heavy. Yield data have been obtained on 21 varieties and selections for part or all of the period from 1911, to 1923, inclusive. Annual and average yields of 19 of these are shown in Table 13, two selections having been discontinued in 1913. The average yields of varieties grown during the 12-year period 1912–1923, show Abruzzes (C. I. No. 40) in the lead with 36.9 bushels to the acre. This variety grows rapidly in the fall and early spring and produces a fine quality of straw when lodging does not occur. Rimpau, a rye maturing a few days later than Abruzzes, ranks second in the 12-year period, with an average yield of 35.3 bushels.

In 1915 the Von Rümker ryes, imported from Germany, were added to the experiments. One of these, Von Rümker No. 2 (C. I. No. 133), leads in yield for the 7-year period 1917–1923, inclusive, by 3.4 bushels per acre, having an average yield of 41.2 bushels and outyielding all 12 varieties in four of the seven years. It was classified in 1915 as a green-seeded rye, but at present approximately 30 per cent of the kernels are brown.

St. John, a Swedish rye, ranks high in yield for the 7-year period, 1917–1923, inclusive, with an average of 37.7 bushels, 0.1 bushel less than Abruzzes (C. I. No. 40). Both Von Rümker No. 2 and St. John are from five to seven days later in maturing than Abruzzes (C. I. No. 40).

Rosen rye, which has been grown during only five years, has produced good yields. Its average yield is 33 bushels, as compared with 34.7 bushels for Von Rümker No. 2 (C. I. No. 133) and 32.4 bushels for Abruzzes (C. I. No. 40) in the same period.

Leaf rust appears to be general on the rye varieties and especially on Rosen, the leaves of which are still green when the epidemic is at its height. Another plant disease not common at Arlington Experiment Farm was present in Rosen rye during 1922, when about 50 heads of loose smut were observed. In 1920 a few smutted heads were found in Rimpau rye, but since then none had been noticed on any variety until 1922, though an annual search has been made.

TABLE 13.—*Yields of the varieties of winter rye grown at the Arlington Experiment Farm in the 13-year period, 1911–1923, inclusive*

Variety	C. I. No.	Annual and average acre yields (bushels)														Average	
		1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1912 to 1923	1917 to 1923
Abruzzes	40		34.6	37.9	35.2	39.9	30.5	51.8	51.0	34.1	35.5	26.7	24.1	41.5	36.9	37.8
Abruzzes selection	40–1					39.9	29.8	50.8	43.8	19.1	18.0	14.0	33.9	35.9		30.8
Arlington Winter	127	15.6	32.7	26.8	41.1											
Giant Winter	30	21.7	37.4	36.3	36.1		21.6	47.2	43.5	20.5	37.3	30.0	25.4	33.6		33.9
Do	30–2	23.8	23.9	29.5	35.7											
Henry	138		32.0	34.3	26.8	30.0	19.5	50.4	44.8	26.1	32.4	34.5	23.2	34.9	32.4	35.2
Invincible												29.8	28.6			
Ivanof	34	12.3	37.7	21.4	34.5	46.1	36.0	55.1	33.5	35.3	34.4	30.4	32.5	26.0	35.2	35.3
Mexican	108	14.3	35.5	28.2	31.8	37.5	34.8	54.3	37.3	17.1	25.5	35.6	29.5	33.0	33.3	33.2
Rimpau	126	22.3	33.8	25.7	35.5	40.6	24.8	51.8	43.8	28.0	33.9	37.7	29.0	38.9	35.3	37.6
Rosen	195									32.5	36.4	32.1	27.0	37.2		
Spring	73	5.5	30.6	36.1	35.5											
St. John	130					33.7	18.8	58.6	39.4	33.7	32.9	36.4	27.0	35.8		37.7
Virginia	128–1	24.3	21.6	27.2	38.6	41.5	21.2	49.3	43.0	32.0	22.9	20.8	33.3	37.4	32.4	34.1
Von Rümker No. 1	173					32.9	31.3	59.0	38.3	12.3	30.5	26.2	38.3	41.8		35.2
Von Rümker No. 2	133					49.9		62.5	52.1	17.5	44.6	34.2	39.0	38.2		41.2
Do	135					44.5		63.2	37.5	21.6						
Do	174					35.4	15.8	60.0	39.7	19.6						
Winter	208							53.2	30.6	24.2	34.3	32.5	14.7	37.7		22.5

Data were recorded in 1921 and 1922 on the number of spikelets and the percentage of seed set on 90 to 100 heads of each of the two varieties, Rosen and Abruzzes. The data for the two years show that Rosen produces on the average 37.2 spikelets to the head as compared with 34.5 for Abruzzes. The latter variety set the higher percentage of seed in 1921 and Rosen in 1922. It is probable that this character is more dependent on external factors than on varietal differences. On the average about two-thirds of the flowers set seed.

The quality of rye produced at the Arlington Experiment Farm, as judged by bushel weight (Table 14), has been poor. Rosen is especially low in bushel weight, and Abruzzes (C. I. No. 40) is of much better quality. Lodging has reduced the bushel weight of the ryes. Table 14 shows other agronomic data obtained on six varieties of winter rye.

TABLE 14.—*Average agronomic data recorded for rye varieties grown at the Arlington Experiment Farm during the stated periods of years*

Variety and period	C. I. No.	Fall growth [1]	Date of—		Height	Acre yields		Bushel weight
			Heading	Maturity		Grain	Straw	
					Inches	*Bushels*	*Pounds*	*Pounds*
1912 to 1923, inclusive:								
Abruzzes	40	Heavy	May 4	June 17	62	36.9	4,069	52.7
Ivanof	34	Medium	May 8	June 19	63	35.2	3,922	52.8
Rimpau	126	Light	May 9	June 22	63	35.3	3,872	51.5
1919 to 1923, inclusive:								
Abruzzes	40	Heavy	May 2	June 15	63	32.4	3,904	52.7
St. John	130	Light	May 8	June 20	65	33.2	4,197	50.9
Von Rümker No. 2	133	do	May 10	June 22	63	34.7	4,890	51.3
Rosen	195	Very light	May 9	June 23	62	33.0	4,168	50.2
Ivanof	34	Medium	May 7	June 19	64	31.7	4,141	53.2
Rimpau	126	Light	May 6	June 21	66	33.5	3,868	52.2

[1] Data on fall vegetative growth are for the period from 1919 to 1922 only.

WINTER OATS

Winter oats have been produced successfully on the Arlington Experiment Farm. Though the data available for a comparison of fall-sown and spring-sown oats are limited, they indicate that spring sowing is much more precarious. In 1911 and 1912 spring oats were grown in nursery rows. The 1911 crop was practically a failure, but in 1912 some varieties produced good yields and others failed. The Burt, Sixty-Day, and Early Champion varieties and several selections from hybrids grown in tenth-acre plats in 1913 produced low yields. The average acre yield of all varieties of spring oats in 1913 was 13.5 bushels.

Fall-sown oats have been grown in the varietal experiments since 1911, and in only 2 of the 12 years (1912 and 1920) has the average yield of all varieties been materially below 40 bushels per acre. The 13-year average of all varieties is practically 47 bushels. In 1912 a minimum winter temperature of −13° F. was recorded in January, and severe winterkilling of the oat varieties resulted, reducing the average yield in that year to 13.1 bushels. The second failure of winter oats occurred in 1920, when the average yield was

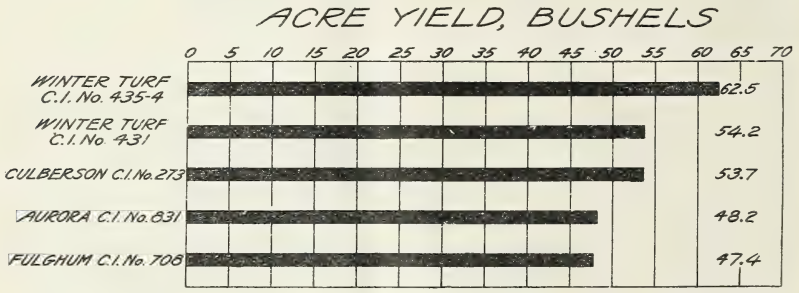

FIG. 6.—Diagram showing the average yields of the principal varieties of oats grown at the Arlington Experiment Farm during the 8-year period, 1916–1923, inclusive

14.5 bushels. The lowest temperature during the winter of 1919–20 was 2° F., yet injury was severe; although the temperature was not extreme, the period of cold weather was more extended than usual. Spring conditions gave the oat plants little opportunity to recover, but favored a heavy growth of dog fennel.

In the winter of 1917–18 it was shown that zero weather alone does not necessarily cause the failure of fall-sown oats. Minimum temperatures ranging from −2° to −7° F. occurred in December, January, and February, yet the average yield of oats in 1918 was almost 53 bushels per acre. Again in 1921–22 a minimum temperature of −2° F. was recorded, but the small grains were protected by an unusually heavy snow and no winter injury was observable. Yields of the oat varieties are shown in Table 15. Varieties grown three years or less prior to 1915 and then discarded are not included. Yields of these varieties were reported in Department Bulletin No. 336. The highest yields of winter oats were produced in 1914, 1919, 1921, and 1922.

Two of the varieties of fall-sown oats, Winter Turf (C. I. No. 431) and Culberson (C. I. No. 273), have been grown each year during th e13-year period, 1911–1923, inclusive. The 13-year average acre

yields of these varieties are 50.7 and 48.4 bushels, respectively. In the 8-year period, 1916–1923, inclusive, five distinct types of oats are represented, viz, Winter Turf, Culberson, Dwarf Culberson, Fulghum,

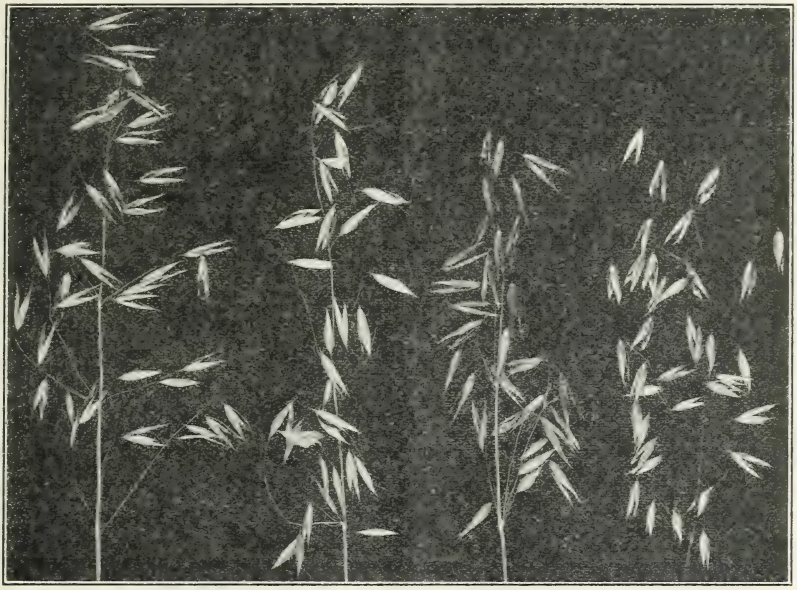

FIG. 7.—Heads of four winter-oat varieties grown at the Arlington Experiment Farm. Left to right: Culberson, Winter Turf, Fulghum, Aurora

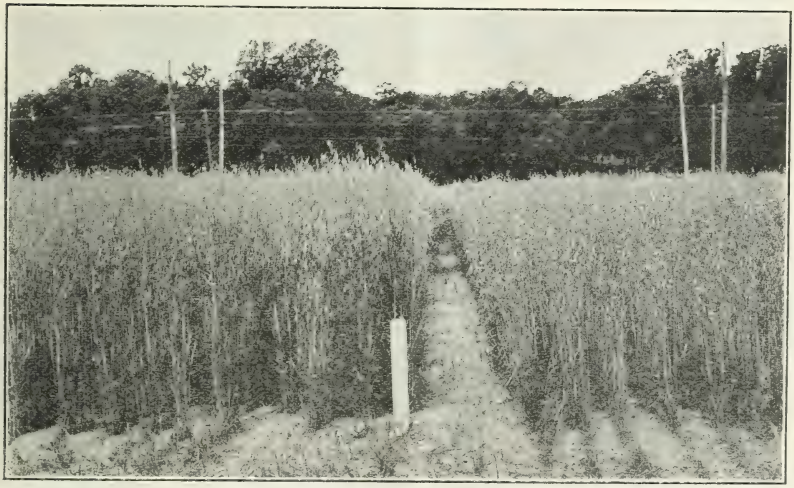

FIG. 8.—Winter Turf oats (C. I. No. 741-4), at the left, and Hatchett oats (C. I. No. 838), at the right, at the Arlington Experiment Farm in 1922

and Aurora. Agronomic data for these strains are presented in Table 16. Figure 6 shows graphically the average yields of the principal varieties during this 8-year period. Representative head samples of several varieties are shown in Figure 7.

TABLE 15.—*Yields of varieties of fall-sown oats grown at the Arlington Experiment Farm in one or more of the 13 years, 1911–1923, inclusive*

Group and variety	C. I. No.	Annual and average acre yields (bushels)													Average, 1916 to 1923
		1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	
Winter Turf:															
Winter Turf	431	29.4	25.3	40.0	61.9	69.0	51.6	59.1	45.4	68.3	21.4	73.5	57.0	57.4	54.2
Winter Turf selection	274–20	26.3	20.7	46.6	64.4	66.6	40.2	48.8	39.1	70.0	21.6	62.8	----	----	------
Winter Turf	427	36.3	18.7	40.0	67.2	75.4	55.3	53.8	----	----	----	----	----	----	------
Do	435	34.1	24.7	35.9	64.1	57.7	----	----	----	----	----	----	----	----	------
Winter Turf selection	435–4	----	----	----	----	----	63.6	67.9	60.6	76.5	21.0	86.9	62.4	61.3	62.5
Do	541–4	----	----	----	----	----	63.3	65.0	53.4	82.9	8.9	98.7	59.6	63.4	61.9
Do	274–I–22	----	----	----	----	----	54.7	57.2	49.9	----	----	----	----	----	------
Do	195–1	----	----	----	----	----	55.6	53.5	----	----	----	----	----	----	------
Do	195–10	----	----	----	----	----	----	----	54.4	56.0	----	----	----	----	------
Do	409–5	----	----	----	----	----	----	----	50.4	81.9	----	----	----	----	------
Culberson:															
Culberson	273	40.9	19.5	33.5	54.6	51.0	38.9	57.6	57.0	71.6	19.7	67.3	53.2	64.5	53.7
Culberson selection	273–19	49.4	24.5	31.9	58.5	48.4	27.5	55.4	----	----	----	----	----	----	------
Do	651	42.8	4.7	19.7	49.3	44.1	----	----	----	----	----	----	----	----	------
Do	273–I–14	----	----	----	----	----	29.0	50.3	55.0	73.8	18.8	58.1	61.3	62.5	51.1
Do	273–I–10	----	----	----	----	----	34.7	36.0	57.8	66.2	17.0	66.0	----	----	------
Do	273–1520	----	----	----	----	----	----	----	----	----	11.0	----	----	----	------
Dwarf Culberson	748	----	----	----	----	----	25.2	53.8	53.6	64.6	16.3	45.1	68.9	52.1	47.5
Bicknell:															
Bicknell	206	33.1	4.7	36.6	59.1	30.5	39.7	51.3	45.5	----	----	----	----	----	------
Bicknell selection	206–3	38.8	10.4	49.8	57.6	15.3	----	----	----	----	----	----	----	----	------
Do	206–7	40.0	10.8	46.6	53.5	27.5	----	----	----	----	----	----	----	----	------
Do	206–10	40.0	2.8	----	53.0	39.6	30.5	48.2	----	----	----	----	----	----	------
Do	206–155	----	----	----	----	----	----	----	----	72.5	15.0	70.4	69.8	70.3	------
Do	206–151	----	----	----	----	----	----	----	----	66.3	----	64.2	----	----	------
Red Rustproof:															
Red Rustproof selection	518–3	63.1	5.9	43.4	61.9	38.6	23.5	45.4	64.8	55.2	----	55.3	----	----	------
Do	236–1	----	----	----	----	----	30.5	16.1	51.5	----	----	----	----	----	------
Do	439–10	----	----	----	----	----	27.8	18.8	----	----	----	----	----	----	------
Turkish Rustproof	356–17	----	----	----	----	----	39.2	----	----	----	----	----	----	----	------
Red Rustproof	1815	----	----	----	----	----	----	----	----	----	----	30.9	62.9	45.4	------
Fulghum:															
Fulghum	699	----	----	----	----	----	29.6	----	----	----	----	----	----	----	------
Do	708	----	----	----	59.5	37.4	27.8	41.4	53.9	70.6	6.6	43.4	68.7	66.4	47.4
Kanota	839	----	----	----	----	----	----	----	----	----	----	----	70.3	68.6	------
Miscellaneous:															
Aurora	831	----	----	----	81.3	29.4	38.6	26.3	53.1	66.0	11.8	67.6	56.0	66.1	48.2
Hatchett	838	----	----	----	----	----	----	----	----	----	13.6	59.0	59.9	65.4	------
Ferguson Navarro	966	----	----	----	----	----	----	----	----	----	----	----	64.2	35.6	------
Ruakura	701	----	----	----	----	32.8	36.3	----	----	----	----	----	----	----	------

The Winter Turf group is outstanding in yielding ability on the basis of the averages shown. In the 8-year period, 1916–1923, inclusive, two pure-line selections from commercial stocks of this variety, C. I. No. 435–4 and C. I. No. 541–4,[7] produced average yields of 62.5 and 61.9 bushels, respectively, surpassing unselected Winter Turf (C. I. No. 431), the next highest yielder, by 8.3 and 7.7 bushels, respectively. The bushel weight of these two selections is low (Table 16) as compared with C. I. No. 431, but the increased yield more than offsets the lower bushel weight. Plats of Winter Turf and Hatchett (C. I. No. 838) oats are shown in Figure 8.

The Winter Turf oat is a late, slow-growing, narrow-leaved variety with a rosette habit of fall growth and is inclined to tiller freely.[8] At heading it normally shows a tall and heavy growth of stems and leaves, and in wet seasons lodging is common. The kernel is plump, grayish white, and often distinctly striated or striped.

[7] These selections were made by C. W. Warburton in 1908.

[8] For a more complete description of fall-sown oat varieties at Arlington Experiment Farm, see U. S. Dept. Agr. Bul. 336.

The Culberson oat, which matures about five days earlier than the Winter Turf, has produced consistently good yields except in the years when all varieties failed. Other than its earlier maturity it appears to have little to recommend it over Winter Turf. It produces a good quality of grain, which is usually white, although some strains are brown or black. Dwarf Culberson, a pure-line selection made by Prof. C. A. Mooers at the Tennessee Agricultural Experiment Station, grows about 10 inches shorter than Culberson and ripens at least three days earlier. The quality of the grain is better, but its average yield is considerably below that of Culberson (Table 16).

The earliest fall-sown oat grown during the period, 1916–1923, inclusive, is Fulghum, which matures two weeks earlier than Winter Turf. Fulghum is a broad-leaved type which makes a heavy vegetative growth in the fall and for this reason is likely to winterkill in years of low temperatures. The grain is plump, reddish brown in color, and of good quality. The plants are several inches shorter than those of Culberson or Winter Turf at maturity and are not so likely to lodge. In favorable seasons Fulghum has produced high yields, but its 7-year average is poor. Aurora, an early yellow pure-line variety selected at the Arlington Experiment Farm, matures with Dwarf Culberson and has yielded slightly better than Fulghum. The kernels are very plump, the 7-year average bushel weight being 34.9 pounds. Aurora has strong, stiff straw, but has been especially susceptible to smut.

TABLE 16.—*Average agronomic data recorded for seven varieties or strains of fall-sown oats grown at the Arlington Experiment Farm during the 8-year period, 1916–1923, inclusive*

Variety	C. I. No.	Date of—		Height	Acre yields		Bushel weight
		Heading	Maturity		Grain	Straw	
				Inches	*Bush.*	*Pounds*	*Pounds*
Winter Turf	431	May 31	June 27	42	54.2	2,676	33.5
Winter Turf selection	435–4	June 1	do	42	62.5	2,894	31.6
Do	541–4	do	do	43	61.9	3,176	31.5
Culberson	273	May 23	June 22	42	53.7	2,688	32.3
Dwarf Culberson	748	May 22	June 19	33	47.5	2,007	33.2
Fulghum	708	May 17	June 12	39	47.4	2,266	32.6
Aurora	831	May 22	June 19	40	48.2	2,178	34.9

Various strains of Bicknell and Red Rustproof have been grown in the varietal experiments at different times. The yields for the 8-year period, 1911–1918, inclusive, show that Bicknell averaged 37.6 bushels and Red Rustproof selection (C. I. No. 518–3) 43.3 bushels, as compared with 47.7 bushels for Winter Turf (C. I. No. 431) and 44.1 bushels for Culberson in the same period.

WINTER BARLEY

The best variety of fall-sown barley has produced acre yields slightly more than those of oats but considerably below those of rye, wheat, or spelt. Winterkilling or winter injury, as in oats, is often a limiting factor in determining the yield, poor yields usually following winters with low temperatures. Covered smut (*Ustilago hordei*) and loose smut (*U. nuda*) are common at the Arlington Experiment Farm, and when the barley seed is untreated the loss often runs as

high as 10 per cent. Treating with formaldehyde or hot water has been practiced following years of considerable smut infection. The treatments, though controlling the smuts, have not been satisfactory because of the lowered germination due to the treatment. Spring-sown barley was grown only in 1915, when the acre yield was 4.2 bushels.

In the varietal experiments 42 varieties and selections of barley have been grown from fall seeding for three or more years. Several of these have been spring varieties which have proved unadapted to fall sowing because of winter injury.

The annual and average yields of 36 varieties and selections of winter barley grown in all or parts of the 14-year period from 1910 to 1923, inclusive, are shown in Table 17. Varieties grown three years or less previous to 1915 and then discarded are not included in this table. Yields of these varieties are reported in Department Bulletin No. 336.

TABLE 17.—*Yields of varieties of winter barley grown at the Arlington Experiment Farm in one or more of the 14 years, 1910–1923, inclusive* [1]

Class and variety	C.I. No.	Acre yields (bushels)															Average		
		1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1910 to 1913	1916 to 1921	1911 to 1921
Six-rowed hulled:																			
Arabel	896		17.3	38.0	28.1	26.3													
Argentine	223			18.2	16.7	33.3	20.4	32.5											
Arlington Awnless	702			20.5	17.5	22.3	20.4	17.8											
Black Russian	705						46.2	34.4	31.3	25.4									
Canada Winter	713		16.0	29.3	25.0	28.5													
Cartouch	1107									36.7	24.4	10.4	10.7						
Cusado	895		18.9	30.5	28.8	29.2	27.2	44.8	39.2	32.5	25.8	13.7	21.2				29.5	28.3	
Flechi	1263						7.0	24.5											
Greece	221	34.1					39.0	49.4	34.4	32.1	29.0	10.9	23.2				29.8		
Han River	2163						45.5	44.9	52.8	37.1	22.9	22.8	23.7	30.8	47.7		34.0		
Khayyam	1117						41.7	33.2	36.5	20.9	24.2	8.2	9.2				22.0		
Nakano Wase	754						39.6	31.7	36.3	0	46.2	4.7	25.4	29.4	41.4		24.1		
Do	2166							37.5	45.3	0	36.7	12.3	16.4	36.7	45.1		24.7		
Do	2164							32.0	39.7	0	40.0	4.4	21.5				22.9		
Do	2165							36.7	44.6										
Niver	737							21.5	29.0										
Pidor	901					32.5	21.9	37.4	48.5	44.4	30.7	19.3	25.1	23.8	32.3		34.2		
Pontius	731							9.8	32.8	32.6	22.7								
Servian	915							38.0											
Scottish Pearl	277				36.0	32.3	22.4	33.6	46.3	30.0	31.5	24.4	28.9	20.4	47.3		32.5		
Squarehead Winter	252			24.2	30.8	27.7				37.5	29.8	15.8	16.7						
Szechwan	664							32.0											
Telli	194	22.5			31.5		13.7												
Tenkau	646		13.3		39.6	32.1	21.8	46.7	50.5	36.7	29.4		17.9	34.5	54.7				
Tennessee Winter [2]	257	23.4	15.0	35.3	21.7	30.7	35.1	40.1	41.9	33.6	31.1	21.3	22.9	32.2	38.9	23.9	31.8	29.9	
Texas Winter	554	28.6	22.8	26.2	22.5	22.8				47.1	24.8	13.7	25.4			25.0			
Union Winter	583					27.1	44.5	43.4											
Virginia	648	45.8	13.4	0	28.4	19.4										21.9			
Wisconsin Winter	2159	14.3	15.4	25.5	31.4	33.5	33.8	42.9	39.6	42.5	39.8	14.6	27.4	50.1	58.3	21.7	34.5	31.5	
Do	2167										38.6	24.5	24.1	34.7	46.2				
Two-rowed hulled:																			
Hanna	287	26.7	14.8	11.8	18.8											18.0			
Nesbian	647		15.9	12.3	24.0	24.8													
Omar	898				25.0	25.6	44.5	37.1	33.7	35.9	24.2								
Orel	351									50.8	48.8	14.1	36.9	37.8	47.2				
Pedigree Chevalier	156	14.6	36.9	7.2	14.6											18.3			
Svanhals	187	20.8	8.3	15.7	25.3	25.8	5.3	30.5	29.6	20.7	25.0	7.0	6.2			17.5	19.8	18.1	
Naked:																			
Hansee Hull-less	703		30.0	25.7	14.1	34.1	21.1	27.4	36.4	9.4	25.0	6.0	19.4				20.6	22.6	

[1] Varieties grown three years or less prior to 1915 and then discarded are not included.
[2] Check variety.

HEADS OF THREE WINTER-BARLEY VARIETIES GROWN AT THE ARLINGTON EXPERIMENT FARM

Left to right: Orel, Nakano Wase, and Wisconsin Winter

CRADLING A PLAT OF WINTER BARLEY AT THE ARLINGTON EXPERIMENT FARM

This method of harvesting is occasionally necessary when a plat of an early variety is located between two later ones

Six-rowed varieties of barley have produced the highest yields. A new strain of Orel, a 2-rowed barley added to the varietal experiment in 1918, is now showing promise, having outyielded all varieties during the 6-year period from 1918 to 1923, inclusive. The 6-rowed barleys which have yielded best are Wisconsin Winter (C. I. No. 2159), Han River (C. I. No. 2163), Pidor, Scottish Pearl, and Tennessee Winter. The Nakano Wase strains are awnless and have in certain years produced good yields, but their very rapid fall growth makes them likely to winterkill. They were entirely killed in the winter of 1917–18, when the weather was unusually cold. Nakano Wase appears to be resistant, however, to both the loose and covered smuts. Plate III shows typical heads of three varieties of winter barley grown at the Arlington Experiment Farm, and Plate IV shows several of the varietal plats of barley just at the beginning of harvest.

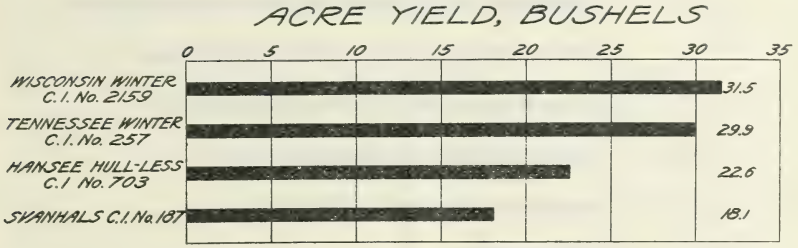

FIG. 9.—Diagram showing the yield of four varieties of winter barley grown at the Arlington Experiment Farm during the 10-year period, 1911–1921, inclusive

Figure 9 shows graphically the yield of several varieties of winter barley during the period from 1911 to 1921, inclusive.

TABLE 18.—*Average agronomic data recorded for five varieties of fall-sown barley grown at the Arlington Experiment Farm during the 7-year period from 1915 to 1921, inclusive*

Variety	C. I. No.	Date when—		Height	Acre yields		Bushel weight
		Fully headed	Ripe		Grain	Straw	
				Inches	*Bushels*	*Pounds*	*Pounds*
Tennessee Winter	257	May 10	June 7	35	32.3	2,019	42.9
Wisconsin Winter	2159	May 14	June 11	35	34.4	2,417	42.6
Svanhals	187	May 11	June 7	35	17.8	1,577	43.4
Hansee Hull-less	703	May 4	June 3	35	20.7	1,611	53.2
Nakano Wase	754	May 3	June 1	34	26.3	1,534	45.7

Table 18 shows further agronomic data for five varieties of barley grown during the 7-year period, 1915–1921, inclusive. The early maturity of the crop is shown, ripening in sufficient time to harvest before wheat or oats. Nakano Wase is an especially early barley, usually ripening about one week before Tennessee Winter. Wisconsin Winter matures late, but produces very high yields. The bushel weights of all varieties except Hansee and the Nakano Wase strains have been low, owing to the persistence with which the awn remains attached to the lemma. In certain years this condition is much more pronounced than in others, owing possibly to weather conditions about harvest time. The presence of the awns also causes difficulty in

obtaining a uniform distribution of seed with the grain drill. For these reasons it is desirable to obtain a high-yielding winter barley which is either awnless or has completely deciduous awns.

COMPARISON OF GRAIN CROPS

The average acre yield of the leading variety of each of the fall-sown cereals during the 13-year period, 1911–1923, inclusive, is shown graphically in Figure 10. The high-yielding ability of spelt is noticeable in comparison with barley or oats. Rye and wheat produce more grain than spelt when deduction is made for the chaff of the latter, which continues to inclose the kernel after threshing.

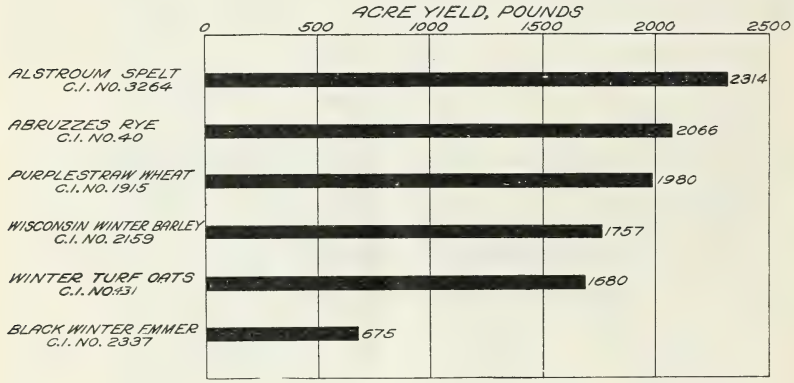

FIG. 10.—Diagram showing the average yield of the leading variety of each of the fall-sown cereals grown at the Arlington Experiment Farm during the 13-year period, 1911–1923, inclusive

SUMMARY

The experiments here reported were conducted on the Arlington Experiment Farm, near Rosslyn, Va., during the 14-year period, 1910–1923, inclusive. The farm is located 2 miles west of Washington, D. C., at an altitude of approximately 50 feet.

The soil on which these experiments were conducted is a gray loam with a subsoil of brick clay, classified as a Keyport silt loam.

The average precipitation for the 12-month period from July 1 to June 30 for the 12-year period during which rainfall has been recorded at the farm is 41.39 inches. The maximum rainfall occurred during the 12 months ended June 30, 1923, when the total was 45.75 inches and the minimum 37.45 inches in the 12 months ended June 30, 1917.

The poorest yields of winter wheat occurred in those years when the total April, May, and June rainfall was heaviest. Low temperatures have reduced the yield of fall-sown oats and winter barley, but winterkilling seldom occurs in wheat and rye.

Spring seeding of wheat, oats, and barley has not resulted in satisfactory yields.

The beardless varieties of winter wheat have produced the highest yields. Varieties producing tall, heavy straw have not been high grain yielders. Seeding winter wheat at the rate of 6 pecks per acre

has returned the highest average net yield. Varieties have responded somewhat differently to different rates of seeding.

Winter spelt produces more pounds of grain to the acre than either winter oats or winter barley. Winter emmer has been a very poor yielder.

Winter rye has given good returns. Abruzzes (C. I. No. 40) and Von Rümker No. 2 (C. I. No. 173) are the highest yielding varieties.

The Winter Turf oat has produced the best yields. Two selections, C. I. Nos. 541–4 and 435–4, are outstanding in yield.

The 6-rowed barleys have outyielded all other types. Wisconsin Winter (C. I. No. 2159) leads in the varietal experiments. Orel, a 2-rowed barley, has produced excellent yields during a 6-year trial.

Winter wheat, rye, spelt, barley, and oats have all produced satisfactory yields. The varieties recommended for eastern Virginia and eastern and southern Maryland are:

Winter wheat: Purplestraw, Potomac, Fultz, Poole, Shepherd, Fulcaster, and Mammoth Red.
Winter spelt: Alstroum.
Winter rye: Abruzzes and Von Rümker No. 2.
Winter oats: Winter Turf and Culberson.
Winter barley: Wisconsin Winter, Orel, Han River, and Pidor.

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